XVIII.—*Parasites of the Spongida.*

By H. J. Carter, F.R.S. &c.

In 1871 ('Annals,' vol. viii. p. 330) I stated that I hoped soon to communicate an "illustrated paper on the parasites of sponges;" and now, after having examined all the specimens of the latter in the collections of the British Museum together with those belonging to the late Dr. Bowerbank, and with my own experience of the living sponges here (Budleigh-Salterton), I propose to notice those parasites which have come under my observation and of which I possess specimens, being well aware that there must be many more which have not been discovered, or, if discovered, have not been made public.

For illustrations I prefer figures which combine that of the sponge with that of the parasite; and therefore reference will be made to these whenever possible, while the rest hardly require any; so that the only illustration that I shall insert will be one of *Spongiophaga communis*, which will be given in a woodcut opposite the description.

Crustaceans.

It seems not uncommon for small Amphipod Crustaceans about 1-12th inch long to nestle in the surface of some sponges, where they make little oval depressions to lie in, more or less bent upon themselves, which depressions, in the absence of the crustaceans, may sometimes be taken for vents. This was first noticed in *Suberites antarcticus*, MS. (a branched Suberite of a grey colour, with large and almost spherical head to its pin-like spicules, dredged up by Sir J. Ross in 300 fathoms in 77½° south latitude), and the crustacean kindly described and illustrated by the Rev. R. R. Stebbing, M.A., under the provisional name of *Dexamine antarctica* ('Annals,' 1875, vol. xv. p. 184, pl. xv. fig. 1, &c.). Similar depressions with a smaller crustacean of a like form were afterwards observed on the surface of a large mouse-coloured, areniferous, estuarian variety of *Suberites domuncula*, Nardo, = *Halichondria suberea*, Johnston, on a *Buccinum* containing a *Pagurus*, probably from the Firth of Forth, Scotland, and, lastly, though of larger size, on a living specimen of *Halichondria incrustans* from this place (Budleigh-Salterton).

Crustaceans are commonly found in the cloaca and halfway through its aperture in *Grantia ciliata* and *G. compressa*, especially towards the maturity of the *gastrula*, which, being free from spicules and rich in nutriment, they devour greedily, not refusing portions of the sponge itself; so that, in gathering

pieces of the seaweed on which *G. compressa* chiefly grows here, it is desirable to free the specimens as much as possible from the Alga, lest, under confinement, the crustaceans issue from their nests in the latter, where they dwell in great abundance, make an onslaught on the *Grantias*, and destroy the greater part of them.

Cirripedes.

The Balanoid Cirripedes, whose embryos are so abundant that they almost cover every thing on the rocks here, together with the rocks themselves, could hardly be expected to refuse the surface of the Spongida; and hence, perhaps, they are the most common parasites of all; for, with the exception of the fleshy sponges (*Carnosa*) and the calcareous ones (*Calcarea*), they make use of every other kind of sponge, becoming, as they increase in size, overgrown by the sponge itself, whether the latter is keratacеous or vitreous, so as to form wart-like excrescences with a hole in the summit for the projection of the cirri. The species appear to vary in the same as well as in different localities; and the term "*Acasta*" has been applied to the whole group by Leach.

Actinozoa or Polyps.

In all parts of the world sponges are more or less infested by polyps, chiefly on the surface, which may be single, double, concatenated, or grouped, isolated or aggregated, sunk to the level of the surface of the sponge which they may infest without scleroderma, or with it *in* the scleroderma *on* the surface of the sponge, or pendent from the scleroderma; and all belong to the Zoanthidæ=Palythoa, Lamour.,=Zoantha of De Blainville.

Of those on the sponges of the Antilles, Duchassaing de Fontbressin states:—

"Les Zoanthes, les Mamillifères et les genres voisins sont littoraux; cependant il y a des exceptions pour quelques-uns des ces êtres, comme le *Zoanthus parasiticus*, le *Gemmaria Swiftii* et les *Bergia*, qui toutes sont parasites des éponges, et que j'ai recueillies par une profondeur variant entre 2 et 8 mètres. Ces espèces ne se trouvent jamais que fixées sur les Spongiaires; elles ne se rencontrent sur aucune autre espèce de corps marins." ('Revue des Zoophytes et des Spongiaires des Antilles,' par M. P. Duchass. de Fontbressin, 1870, p. 22.)

Such are the words of this naturalist, who, with M. (afterwards le Chevalier) G. Michelotti, published copiously illustrated works on the corals and sponges respectively of

the Antilles and the Caribbean Sea, gathered by themselves alive and dead in these localities before the year 1864 ("Spongiaires de la Mer Caraïbe, par P. Duchass. de Fontbressin et G. Michelotti," Natuurk. Holland. Maat. Wet. te Harlem, 1864, vol. xxi. 4to).

The character of these polyps is to have their sclerodermic parts more or less charged with foreign bodies, viz. grains of sand and sponge-spicules entire and fragmentary, derived from the sponges of the locality generally, but chiefly from the sponge on which they may be situated. I can, of course, state nothing of the softer parts in their original condition, as my descriptions are taken from dried specimens; hence *this* information must be sought from other sources.

1. *Polyps single or isolated, scattered over the surface more or less generally, sunk to the level of the sponge, but marginated; about* 1-16 *inch in diameter.*

Especially observed in the genus *Tuba*, Duchass. de F. et Mich. (*op. cit.*, e. g. *T. digitalis*, pl. viii. f. 2), Rhaphidonemata, fam. Cavochalinida, groups 6–8, Cart. ("Notes Introductory to the Study of the Spongida," 'Annals,' vol. xvi. p. 141) = *Siphonochalina*, Sdt.; also in *Reniera fibulata*, Sdt. (Holorhaphidota, group 5. Fibulifera, Cart. *op. cit.* p. 178), from the seas between the Americas; also in *Axinella polypoides*, Sdt., from the Adriatic sea (Schmidt, Spong. Adriat. Meeres, Taf. vi. f. 4).

2. *Polyps single or concatenated, scattered over the surface more or less generally, sunk to the level of the sponge, but marginated; about the same size as the foregoing.*

See especially the genus *Thalysias*, D. de F. et M. (*op. cit.*), Holorhaphidota, group 3. Thalyosa, Cart. (*l. c.*). For a good figure see *Isodictya mirabilis*, Bk. (Proc. Zool. Soc. Lond. 1873, pl. xxviii. figs. 1, 6, 8), = *Thalysias subtriangularis*, D. de F. et M., 1864 (*op. cit.* pl. xvii. fig. 1), from the seas between the Americas. The name used by Dr. Bowerbank must be suppressed, as it was given long after that of D. de F. et M.; and that of "inhalant pocilla" applied by him to the polyps is a mistake, carried on from his description and figure of 1864 (Mon. Brit. Spong. vol. i. p. 278, pl. xx. f. 308). The description, however, faithfully illustrated by his artist Lens Aldous, records all that is necessary respecting the dried form of the polyp.

Should instances of circumscribed *inhalant* caliciform or tentaculiform areæ in sponges be desired, they may be found in *Grayella cyathophora* and *Cliona corallinoides* respectively,

as represented in the 'Annals' (the former in 1869, vol. iv. pl. vii., and the latter in 1871, vol. viii. pl. ii.).

3. *Polyps single, double, concatenated or irregularly grouped; sunk into a scleroderma upon, but not into, the surface of the sponge; circumference of the polyp defined but not marginated, about* 1-12*th inch in diameter.*

See especially *Echinonema typicum*, Cart. MS. (Echinonemata, fam. Ectyonida, group 1. Pluriformia, *op. cit.* p. 143, &c.). From Freemantle, S.W. Australia. *Very* common on the branched digitate form.

4. *Polyps single, double, or irregularly grouped, more or less pendent from their scleroderma, situated upon the surface of the sponge; sometimes* 1-4*th inch long.*

Ex. gr. *Axinella damicornis*, Sdt., and *A. verrucosa*, Sdt. (Spong. Adriat. Meeres, Taf. vi. figs. 2 and 3 respectively, 1862). *Palythoa axinellæ* is Schmidt's name for this polyp, which is more pendent but smaller in the head than the following species, viz. *Palythoa fatua*, M. Schultze ('Hyalonemen,' 1860, S. 27, *ff*), which grows over the upper part of the glass cord of both *Hyalonema Sieboldii*, Gray, from Japan, and *H. lusitanicum*, Boc., from the Atlantic, on the coast of Spain and the north of Scotland. See *H. mirabilis*, Gray (Proc. Zool. Soc. Lond. 1857, =*H. Sieboldii*, Gray, 1835, *ib.*), partly copied into Dr. Bowerbank's 'Mon. Brit. Spong.' vol. i. p. 287, pl. xxxv. f. 374, where the polyps are considered by Dr. Bowerbank to be the "oscula" and *not* the "inhalant areæ" of the sponge, as stated and delineated in fig. 308, *ib.*, before mentioned! This somewhat ficoid species occurs on the depressed and sessile forms of *Tethea muricata*, var., Bk.,=*Normania crassa*, Bk. (Mon. Brit. Spong. vol. iii. 1870, pl. lxxxi. fig. 1), where there is a group of four figured *without indication*, on the right side of the median line close to the upper margin, which I recognize here, especially, because the same thing occurs on a similar specimen dredged up on board H.M.S. 'Porcupine' between the north of Scotland and the Färoe Islands.

With reference, however, to Duchassaing de Fontbressin's statement before quoted, viz. that the parasitic polyps of sponges to which he alludes do not occur on any other marine organisms, there is, in the British Museum, a flat, elliptical, sessile mass or colony of *Hydroid* podocorynid polyps about three inches long and one tenth of an inch thick, whose delicate, erect, colourless filaments in juxtaposition, like the hairs of a clothes-brush, rising from a tough matted mycelium, present an even surface of hydranths on the top sufficiently

firm to support several patches of a parasitic polyp, to me identical with the *Palythoa fatua* of the glass cord in *Hyalonema Sieboldii* &c.

On the other hand they are present at such an early period in some sponges that at first it seems as if they were part of the sponge itself, or, at least, developed in combination with it. But when we reflect on the unerring certainty with which the pollen-grains of dicœcious plants find their way to the stigma of the female flower *through the air*, and, indeed, the spermatozoa of the myriads of beings, both animal and vegetable, growing together on our shores, find their respective species amidst hosts of others on the same errand, *through the sea*, we cannot wonder that a similar instinct directs the parasitic Zoanthidæ in their embryonic state to find the objects on which they respectively prefer to dwell. At the same time, as these polyps are not seen on the sponge at a very early stage of development, nor are always present on the same species, it is evident that they are not a part of the sponge, nor developed *pari passu* with it; while it is equally evident that, in the *first* instance, they must have come from an unparasitic *Palythoa*, and therefore have obtained their specific differences subsequently, although, when once these have been obtained, they continue, from adaptation, to prefer their new habitat to that of the original stock. This, indeed, is the law of adaptation and inheritance.

Hydrozoa or Hydroid Polyps.

While in all cases of Actinozoic parasitism that have come to my notice in sponges the polyps have been *confined to the surface*, those of Hydrozoic parasitism have extended into *the deepest parts of the sponge*, and, in one instance, have been entirely confined to the interior.

Taking, first, those whose tubes opened on the surface—one was found by Dr. Allman in a "horny sponge on the southern shores of France" and called by its discoverer "*Stephanoscyphus mirabilis*" (Trans. Linn. Soc. 1875, ser. 2, vol. i. pt. i. tab. xiv.; and 'Nature,' 1874, July 30, p. 251); and the other in *Reniera fibulata*, Sdt., *Suberites flavus*, Liebkh., *Esperia Bauriana*, Sdt., and *Myxilla fascicularis*, Liebkh., respectively, by Prof. F. E. Schulze in the Adriatic Sea, who designated it *Spongicola fistularis* (Archiv f. mikroskop. Anat. 1877, Bd. xiii. p. 795, Taf. 45–47); while the instance in which the Hydrozoon was confined to the interior of the sponge occurred to myself, and was noticed in a specimen of *Reniera* (*R. polypifera*, Cart. MS.) from Bona

Bay on the north coast of Africa ('Annals,' 1872, vol. x. p. 50).

Of *Stephanoscyphus mirabilis* Dr. Allman states that it "may be found attached to stones in small patches of one of the horny sponges," of which the figure in the Trans. Linn. Soc. (*l. c.*), being of the "natural size," is about two inches in diameter and half an inch thick in the middle. This consisted of a "congeries of tubes which penetrate the sponge-tissue and open on its surface," being, with their contents, "united by a common tubular plexus towards the base of the sponge" ('Nature,' *l. c.*).

On the other hand, *Spongicola fistularis* is stated by Dr. Schulze to consist of a series of branched tubes (*l. c.* Taf. xlvii. fig. 8), opening on the surface of the sponge by one end (Taf. lxv. fig. 1), and closed or blind at the other. Hence *Stephanoscyphus mirabilis* not only differed from *Spongicola fistularis* in this way, but the former being in a "horny sponge" seems to intimate, although the kind is not mentioned, that it was in a totally different order from all those bearing the hydrozoon so elaborately described and beautifully illustrated by Dr. Schulze.

In my own case, where the polyps were situated in the interior of the sponge, I have nothing to add beyond what has already been stated, 'Annals,' *l. c.* (for the specimen was returned, with all the rest of the sponges dredged up on board H.M.S. 'Porcupine,' to Sir Wyville Thomson last year, 'Annals,' vol. xix. p. 432), viz. that "the minute delicate polyps were seated in dilated cavities, apparently of the excretory canals, the disk or head of each polyp averaging 1-100th inch in diameter, and supported on a short neck, which ended in a little saccular prolongation that was sunk into the parenchyma or sarcode of the sponge, and charged in its walls, as well as in its tentacles, with thread-cells, &c." But that my object then was chiefly to show that the thread-cells observed by Eimer in *Reniera fibulata* and *Desmacella vagabunda*, Sdt., probably did not belong to the sponge, as subsequently confirmed by Schulze's observations (*l.c.* p. 799), I should probably have paid more attention to the structure of the polyp itself, which, however, from its minuteness, position, and exserted tentacles, might be inferred to have been a Hydroid rather than an Actinozoid polyp like that of *Palythoa*.

Algoid Parasites.

Seaweeds.

It is not an uncommon occurrence in some parts of the

world for a seaweed to become a pseudomorph of a sponge (to use a mineralogical term), in which the latter, like a "dissolving view," may be observed (through different specimens) to yield gradually to the former, so that, at last, the seaweed not only assumes the shape of the sponge generally, but that of the form and position of the vents and every other part of the sponge saving the spicules, or foreign bodies of a like nature, which thus are often the only remaining evidence of the *kind* of sponge that has thus been pseudomorphosed.

I noticed this first in specimens of *Reniera fibulata*, Sdt., from Hong Kong, in the British Museum, wherein parts of the sponge itself still remained to prove what has been just stated; and since then several specimens have been added from the late Dr. Bowerbank's collection, that were obtained from Freemantle on the south-west coast of Australia—which led me to seek for the seaweed in Harvey's 'Phycologia Australica,' where I found it figured under the name of "*Thamnoclonium flabelliforme*," also from Freemantle (vol. ii. pl. 13).

The fan-shaped pseudomorphs in the British Museum represent the figure, and bear remains of the spiculation of this form of *Echinonema typicum*, Cart. MS., which is very common at Freemantle; another, that of a Suberite with pin-like spicules only (that is, without any flesh-spicules); and a third bears on its surface portions of the reticulated incrustation of foreign bodies characterizing many of the Psammonematous sponges.

Frequently, as stated by Harvey, on the more prominent parts of this parasitic seaweed may be observed little pedicelled leaf-like expansions or young fronds, which, when softened by soaking in water, present "tetraspores lodged in discoid nemathecia, in their substance;" and thus far the reproductive elements of this Alga have been discovered.

Red Alga parasitic in Halichondria plumosa, *Johnston.*

There is an amorphous Alga (apparently undescribed) which infests some specimens of *Halichondria plumosa* on this coast, consisting of a pseudofrondaceous expansion of carmine-red cells, which, pursuing in its growth the main branches of the skeleton, from the base to their termination on the surface of the sponge, finally produce a dark-brown-coloured, equally amorphous, wart-like fructification.

Its cells are irregularly globular, of a beautiful carmine colour, and held together by a gelatinous membrane, which not only grows upwards round the axis of the branches men-

tioned, but extends outwards laterally for some distance over the echinating spicules of which they are respectively chiefly composed, finally ending on the surface in a clathrate structure, which throws out small, irregular, wart-like, botryoidal masses of a black-brown colour (in sizes below 1-36th inch in diameter). The latter are composed of a crust formed of radiating columns of brown cells in juxtaposition (each column consisting of a transparent theca enclosing about a dozen), containing, or accompanied by, or both, globular tufts of branched short filaments of *red* cells mixed with paraphyses, the filaments being clavate from the enlargement of the cells towards the free ends, thus becoming terminally (?) sporiferous, much like those of *Hypoglossum Woodwardii* figured by Payer (Botan. Cryptogamique, 1850, p. 47, fig. 209). No tetraspores could be recognized; but where the pseudofrondaceous layer had left the sponge and spread itself over surrounding *Balanus*-shells, it presented somewhat the appearance of *Hildenbrandtia sanguinea.*

The red cells of the thallus are about 1-4000th inch in diameter, and the brown cells of the columns about a third smaller, while the terminal cells of the branched filaments in the "tufts" are the largest of all. The brown warty fructification (?nemathecia) is surrounded by a transparent membranous envelope; but this, as well as all the other structures that I have mentioned, can only be seen under the microscope in a fresh state, or on soaking in water, after having become dry. The red colouring-matter of the cells is not affected by drying, nor is it much altered by the addition of liquor potassæ.

As this Alga appears to be unnamed and undescribed, this can be best done by those who have given their attention especially to the subject.

Oscillatoria.

There is a Suberite with pin-like spicule only (that is, without flesh-spicule), which occurs on the rocks here a little above low-water mark, in small thin patches about half an inch in diameter, of a beautiful cobalt-blue colour; and when examined with a microscope the blue colour is found to be owing to the presence of innumerable short separate filaments of an Oscillatorian alga, which, answering to the description of the genus *Hypheothrix*, Kg., but with blue granules, from which the cobalt-blue colour of the sponge is derived, might be called "*H. cærulea.*" The filaments vary in length under 1-1500th inch, with a diameter of 1-12000th inch; and the

colour fades much on drying, but does not altogether disappear.

Scytonema.

A species of this Alga with its germinating gonidia still retaining their dark yellowish-green colour, is abundant in a specimen of *Spongia otahetica* in the British Museum, about which there are no remains of sarcode ; so that it was probably after the death of the sponge that this Alga took up its abode there. It is therefore only mentioned here to show that, in describing the parasites of sponges, the circumstances under which they occur should not be forgotten ; otherwise much more may be set down than really belongs to such parasitism.

There are also destructive organisms which not only attack the horny parts of the skeleton but the spicules themselves of a sponge after death, such as have been described and figured in the 'Annals' for 1873 (vol. xii. p. 457, pl. xvi. figs. 8, 9).

Palmella spongiarum, Cart.

In two instances I have found at this place sponges which have been rendered pink by the presence of a little spherical cell in great abundance, about the size of the human blood-globule,—viz. one in a specimen of *Halichondria panicea*, and the other in a specimen of *Cliona celata*. And on examining it with a microscope, I find that one mode of reproduction is by duplicate division, and that it is enveloped in a mucilage, which, as the *Palmella* grows and the cells become multiplied, thus extends itself throughout the sponge, and, by the immense number of its cells, produces the pink colour. The colour fades to a certain extent, but not altogether, on drying, and is changed to green on the addition of liquor potassæ, when it becomes very like a green *Protococcus*. While retaining the pink colour, it has very much the appearance, under the microscope, of *P. nivalis*, but is much smaller. It averages 1-2400th inch in diameter ; and, not being polymorphic (that is, not being able to change its spherical form), it cannot be confounded with the ovules of the sponge, especially when of this size.

? Saprolegnieæ.

Spongiophaga communis, Cart. 1871.

This is a minute, short, nematoid filament, with a bulb at each end, which, multiplying to an enormous extent, espe-

cially in the *Hircinidæ* (Hirciniosa, 3rd Group, 'Annals,' *l. c.* p. 136), may, like the seaweed *Thamnoclonium flabelliforme*, become a pseudomorph of the sponge it attacks, so as to be mistaken for the sponge itself, as will presently appear.

In 1859 (Archiv f. Anat. u. Phys. Heft iii. p. 369, pl. x. fig. 2), Lieberkühn considered this filament to be a character of certain *Hircinidæ*, which he called "Filifera;" and in 1862, Schmidt (Spong. Adriat. Meeres, p. 30) accepted the character and proposed for the genus the following diagnosis:—

> "Ceraospongiæ duplici fibrarum genere præditæ, uno crassiorum, quæ inter se cohærentes sceletum proprie formant, altero subtilissimarum, quæ ex illis provenientes minutissimis capitulis terminantur et inter se non implicantur."

According to Schmidt (*op. et loc. cit.*), it was observed by Esper, who likened it to "wool;" but neither Esper nor Nardo made it a "character" of *Hircinia*.

In 1845 ('Annals,' vol. xvi. p. 407, pl. xiv. figs. 1–5) Dr. Bowerbank represented it as a "most remarkable character" in his genus *Stemmatumenia*; and in 1864, Duchassaing de Fontbressin and G. Michelotti partly founded their genus "*Polytherses*" upon this parasite, which they describe as "moniliforme," and figure with transverse *septa*, like the filament of an *Oscillatorium* ("Spongiaires de la Mer Caraïbe," *l. c.* pl. i. F, and pl. xii. fig. 5, &c. species).

In 1871 ('Annals,' vol. viii. p. 330) I stated that this filament was an Alga, and probably an *Oscillatorium*, which, from its frequently infesting sponges of different kinds in all quarters of the globe, I proposed to name "*Spongiophaga communis*;" further, it was then stated that "Schmidt (1862, Spong. Adriat. Meeres, and especially with figures in 1864, 1st supplement), after having given a great deal of attention to these filaments, which have a cell at one end and a spiral twist throughout, admits that they are different from the sponge-cell *par excellence* (*i. e.* the sponge-animal), and, after alluding to Kölliker's doubt in 1866, viz. whether it be a part of the sponge or a parasite, agrees in 1870 (Atlantisch. Spongienf.) with Kölliker, that the two structures, viz. the sponge-fibre and the fibrillæ, are different, finally ending with the expression that, after much trouble, he can state nothing further respecting the nature of the latter."

To this may be added Schmidt's opinion in 1878, at least, in a paper entitled "Die Fibrillen der Spongiengattung, Filifera, Lkhn.," of which he kindly sent me a copy in May last, viz. "Meine Angabe, dass die Fibrillen von Hornfasern ent-

springen, beruhte auf Täuschung" (pp. 661–2), and, further on, that all attempts to get out an "entire" fibril fail. But it will presently be seen, in the special description of *Spongiophaga communis* which I am about to give, that this has been accomplished, although probably owing to the specimen being more favourable for the purpose than any possessed by Dr. Schmidt.

Figures of the filament, so far as it was known, have been given respectively by Lieberkühn, Bowerbank, Schmidt, and, lastly, by Duchassaing de Fontbressin and Michelotti, whose "moniliform" or septate character, before noticed, partly led me to the idea that it was a species of *Oscillatorium*, which further investigation has not confirmed.

As before stated, this parasite chiefly, but not exclusively, attacks the *Hircinidæ* in all quarters of the globe, but becomes most remarkable when it has *entirely* replaced the sarcode in those great bowl-shaped specimens that come from the seas between the two Americas and from the southern coast of Australia respectively. The specimen represented by Duchassaing and Michelot (*l. c.*), viz. *Polytherses campana*, is not an uncommon form, wherein the "bowl" has not been completed; while there are large massive forms also of this species of *Hircinia*, and some from the neighbourhood of Cuba, which present *no* filament; but, lest it should be fancied that these might have belonged to a different species and *therefore* not to possess the filament, it might be stated that in the British Museum there are some "bowl-shaped" ones from Australia which present nothing but the original sarcode, and others nothing but the filament respectively covering their skeletons, which thus, in each instance, retain the "bowl-shaped" form of the original sponge.

Besides this, it is abundant in a specimen of *Axinella faveolaria*, Sdt. (mihi), three feet long, which came from the Levant, and was presented to the British Museum by Admiral Spratt, also in several specimens of *Reniera fibulata*, Sdt., *Esperia*, &c., and in one instance even *in the excavated chambers* of a *Cliona* in an old piece of stony coral from Cuba, where it is mixed up with the pin-like spicules of the species, which may be seen together with it in the mounted preparation.

I have not yet observed it in any of the Rhaphidonemata—although, on the other hand, the Cavochalinida, ex. gr. *Tuba* (Duch. de F. et M.), which also chiefly come from the seas between the Americas, are, as before stated, commonly infested by the "isolated sunken polyp" or *Palythoa*.

Then, again, although it is prevalent in several kinds of the Psammonemata besides *Hircinia*, it seems to have almost

an antipathy to the officinal sponge, in the midst of which it may be seen to polymorphose the whole of the *Hircinia* (when the two have thus grown together), without sending a single filament into the *officinal sponge.*

After these statements it need hardly be added that the filament is a parasite affecting many kinds of sponges, and that therefore it cannot form a specific character of any. It will now be described, then, as such, in the *mass* or *tissue* and in the *element* respectively, under the name proposed for it in 1871, viz. :—

Spongiophaga communis, Cart.
(See figure.)

Tissue, when fresh, soft, flexible, gelatinous; when dry, papyraceous, tough, and when torn, in this state, tomentose. Composed of fibrillæ replacing partly or entirely the sarcode of various kinds of sponges, chiefly the Hircinida. Fibril about one third of an inch long, composed of a fusiform filament terminated at each end by a bulbous inflation which is similar; filament $1\frac{1}{2}$-6000th inch broad in the centre, diminishing gradually on both sides to half this diameter at the extremities; bulbous inflation more or less ovoid with the narrow end towards the filament, averaging 2 by $1\frac{1}{3}$-6000th inch in its greatest diameters; filament consisting of a transparent sheath filled with a gelatinous colourless substance in which no structure is visible until solution of iodine in hydriodate of potass is applied, when it becomes of an amber colour, assumes a spiral form, and the whole filament, if doubled upon itself, becomes rapidly intertwisted like the strands of a rope, returning to its natural state both outwardly and inwardly when the solution of iodine is washed out with water, so as to reassume its original appearance in every way. Internal contents

Spongiophaga communis (artificially arranged).

Scale about 1-24th to 1-1800th inch.

slightly issuing from the broken ends of a divided filament, where they contrast strongly with the colourless state of the sheath under the application of the iodine solution; sheath circularly corrugated from retraction at this part, and presenting lines of corrugation on the *inner* side of a bend, but *no septa internally.* Contents of the bulb apparently the same as those of the sheath, with the addition of an indistinct nuclear body surrounded by a granular plasma, presenting a vacuole in the centre, but very variable in appearance in these respects, becoming of an amber colour under the effect of iodine, not purple like that of potato-starch &c. Filament sometimes swollen in the larger part by a nuclear body like that of the bulb, and, in like manner, often slightly accuminate at one point. When dry, highly hygrometric, twisting about on the field of the microscope on being breathed upon, like the elaters of an *Equisetum*-spore similarly circumstanced.

Hab. Marine. Infesting and destroying the sarcode of many kinds of sponges, especially the *Hircinidæ.*

Loc. Worldwide.

Obs. This parasite is not a commensalist, but a devourer of its host, like the seaweed *Thamnocloniumflabelliforme*—finally, in the Hircinida, replacing the entire sarcode so as (as before stated) to present a pseudomorph *only* of these sponges. Sometimes a few fibrillæ are a little thinner than the others in the rest of the mass; and in some sponges they are altogether thinner than in others, as in *Sarcotragus spinulosus*, Sdt., where they are *all* thinner than in *Hircinia variabilis*, Sdt., as seen in the type specimens of these sponges respectively in the British Museum; but this is the only difference that I have observed in them worth noticing in a developmental point of view. The bulb often varies slightly in shape; and the filament appears to be sometimes *once* branched; but in what form the branch terminates I am not able to state, having only observed it once; besides, these varieties can only be viewed as anomalies. Under no circumstances have I been able to satisfy myself that the contents of the filament are septate. As with the smaller, coreless, horny sponge-fibre, so with this filament, decomposition of the contents of the interior leads to the formation of oleaginous globules, which, presenting shades of colour varying from ochraceous yellow to rusty red, cause the tissue formed by them to present these colours respectively.

Although dyeing with magenta and mounting some of the filaments of a specimen that I possess which has been preserved in spirit has given the *entire* form, nothing that I

have yet seen has led me to a knowledge of the mode of reproduction and development; nor have I ever noticed any more decided difference in the size of the filaments than that mentioned. The whole of this part remains for future observation to determine; and it appears to me that such information can only be obtained from *living* specimens.

The filament resembles *Vaucheria* in its contents being continuous and not septate. *Vaucheria* also presents a faint resemblance to it in the terminal enlargements of its filament, which here are for reproductive purposes; but there is no chlorophyl in *Spongiophaga communis*, and in no other respect is it like *Vaucheria*.

There is an entophytic Saprolegnious cell (? *Pythium*, Pringsheim) which bores its way through the sheath of *Spirogyra*, especially under conjugation of the latter, and, entering the sporangium by tubulation, again becomes inflated there, nourishing itself with the contents of the sporangium, and finally producing a young brood in the inner cell or inflation, which may escape into the sporangium itself—or in the outer inflation, where the embryos may escape into the water—probably in these respects being influenced by the best prospect of support. Here, of course, there is no chlorophyl, and there are no septa in the tubulation, while the contents, until they become differentiated into a new brood, appear to be composed of structureless transparent plasma, presenting throughout nothing but an amber colour on the application of iodine.

How far *Spongiophaga communis* may be allied to the Saprolegnieæ I am not able to state; while its habits so far resemble those of *Thamnoclonium flabelliforme* as to produce in some *Hircinia*, as before stated, a pseudomorph of the sponge, in which hardly any thing more remains than the foreign objects which formed the core or axis of the horny fibre.

Saprolegnious Mycelium.

In 1845 ('Annals,' vol. xvi. p. 405, pl. xiii. figs. 1–6) Dr. Bowerbank described a new genus of sponges under the name of "*Auliskia*," which was characterized by the presence of "minute cæcoid canals radiating from the fibre in every direction." These, however, Schmidt, in his critique on the synonyms and species of the Keratospongia (Spong. Adriat. Meeres, 1866, 2nd Suppl. p. 10), considered algoid, and therefore rightly observed that the genus should be suppressed. I had also observed it in two or three instances, and had regarded it in the same light—that is, of the same nature as the

tortuous, branched, tubular filament which sooner or later infests almost every hard marine organization, both kerataceous and calcareous. How far it may occur after death I am not able to state; but it is present in the fibre of *Aplysina capensis*, Cart. MS. ('Annals,' 1875, vol. xvi. p. 192)—that is, a reddish, purple, massive hircinoid *pseudoceratinal* sponge from Algoa Bay, which, from the presence of the sarcode, appears to have been living when taken up for preservation.

Thus Dr. Bowerbank's genera respectively, viz. "*Stemmatumenia*" and "*Auliskia*" were founded on the presence of a parasite, and that following, viz. "*Cartilospongia*" (*ib.* p. 408, pl. xiv. figs. 6–8), upon the structure of a compressed, circular, cake-shaped piece of bone! Curiously enough, in examining Dr. Bowerbank's collection, the identical bone has come before me, which appears to be the body of a *fœtal* whale's vertebra, bearing the exact dimensions and descriptive characters given by Dr. Bowerbank (*l. c.*). At first sight it is very much like the skeleton of a sponge of this shape; but the odour evolved by making a vertical section of it through the short axis, and the microscopic examination, place beyond a doubt its true nature. As Dr. Bowerbank was a good observer, his description and illustrations are valuable from their correctness; but his inference was incorrect.

Foreign Objects.

Although these, being without life before they were taken up by the sponge, cannot be considered parasites, yet there is one which so frequently occurs in the Psammonemata, so like a mineral product, and often so abundantly, that it demands a passing observation here. I allude to a little prism of *calcite* banded occasionally with yellow, brown, red, or amethystine colours, separately or more or less united in the same prism. It occurs in these sponges generally, but most plentifully in the Arenosa from Port Jackson; and hence I thought at first that it must come from some mineral source there; however, one day finding groups of these prisms *in situ* in a large specimen of an *Esperia* from Southern Australia, which had also enclosed some bivalve shells like *Crenatula phasianoptera*, I was led to compare them with the structure of the latter, and immediately saw that, everywhere, their source must be from the disintegration of thin shells like this, which are made up of similar prisms, coloured in accordance with the shells from which they are derived.

Dendrites.

Very often, on old keratacеous fibre, little, colourless, circular dentritic spots make their appearance whose structure is so minute that even under a compound power of $\frac{1}{4}$ inch with high ocular it does not appear satisfactorily. All that can at present be stated of them is, that they are composed of branched filaments which radiate from a central point; but whether they are algoid or fungoid, or what their real nature is, future observation must determine.

Rot.

Lately several complaints have been made of the rapid washing away of officinal sponges after they have begun to be used; and on microscopical examination of such sponges before and after they have been brought into use, it would appear that while the superficial fibre is all continuous, that within is broken up into short pieces. How and when this occurs I am unable to state, further than that, like dried fish not properly cured, the surface may remain good while the interior becomes broken down by putrefaction; or it may be from some chemical substance used in preparing them for sale, which has not been thoroughly washed out from the interior; but the surface remaining sound in each instance would ensure their sale until the unfortuate purchaser finds out that, after a little usage, they become reduced to nothing, and that the soundness was merely superficial. Perhaps the best test of a sound sponge is the extent to which it expands, and *vice versâ*, after having been filled with water. Those which are broken down in the interior, not having the same amount of resiliency as the rest, will probably vary little in size by the change. (For an excellent account, with illustration, of the mode in which the officinal sponge is obtained in the Levant, see 'Travels and Researches in Crete,' by Captain (now Admiral) T. A. B. Spratt, R.N., C.B., F.R.S., &c., vol. i. chap. xx. p. 215, 1865: Van Voorst.)

XIX.—*Measurements of the Red Blood-corpuscles of the American Manatee* (Manatus americanus) *and* Beluga leucas. By George Gulliver, B.A., Pemb. Coll. Oxon.

Through the kindness of Mr. Carrington I have been enabled to examine the blood of the American Manatee now in the Royal Aquarium, and have made careful measurements and comparisons of the red corpuscles.